ACTUATION DEVICE FOR A FLAP ELEMENT

[0001] The invention relates to an actuation device for a flap element, in particular for a variable top receptacle, which actuation device assists the movement of a flap element respectively from a first position into a second position and from the second position into the first position.

[0002] Such top receptacles are provided in vehicles having a flap- or folding top in order to be able to better utilize the storage space located underneath the top receptacle when the vehicle is closed, i.e. in the state, in which the flap- or folding top is not loaded into the top receptacle. For this purpose, the top receptacle is brought into a high position, so that the largest possible volume for accommodating luggage pieces is provided underneath the variable top receptacle. On the other hand, when the flap- or folding top is opened, the flap- or folding top is deposited into the top receptacle that is shifted to a low position.

[0003] Other applications of the actuation device are, e.g., flap coverings of glove compartments, door pockets and center consoles.

[0004] An actuation apparatus for a variable top receptacle is known from DE 197 13 606 C1, which apparatus moves a top compartment floor that is formed from three plate-shaped wall elements. The movement is initiated by an angled handle that is accessible from the luggage space and is fixedly borne on one of the wall elements. One end of a pneumatic spring is attached to a further wall element; the other end of the pneumatic spring is pivotably borne on the chassis. The pneumatic spring assists the movement of the top receptacle from the low position to the high position, wherein at the beginning the movement is damped by the pneumatic spring. In addition, the actuation apparatus of DE 197 13 606 C1 includes a latching hook that is pivotable at the high position of the top receptacle into the latched position, thereby fixing the position of one of the wall elements in order to prevent movement of the top compartment floor. The latching hook is biased by an upper dead point spring alternatively either into the release position or into the latched position.

[0005] It is the object of the invention to provide an actuation device for a flap element, in particular a variable top receptacle, which actuation device is compact, requires less installation space and is cheaper.

[0006] This object is solved by the actuation device having the features of claim 1. Preferred embodiments are provided by the dependent claims.

[0007] The concept underlying the invention is to replace actuation mechanisms, which utilize these pneumatic springs, with a device, by means of which device, on the one hand, the movement of the top receptacle can be assisted from the first position into the second position and vice versa and on the other hand, the latching function can concurrently be undertaken in the respective end positions. By means of the fixedly borne spring element, it is not necessary to provide any movement space for the spring element and a bracket supporting the spring element, respectively. Rather, the spring element can be compactly mounted at a location in the rear area at which the spring element can be accommodated with little interference.

[0008] By the term "fixed bearing", a bearing is to be understood, by which translational movements as well as rotational movements of the spring element at the bearing position are excluded. If the bearing position is provided, e.g., on the rear lid of the motor vehicle, it is understood that the spring element and/or the bracket holding the spring element is (are) movable together with the rear lid, but is (are) not movable relative thereto. Moreover, an elastic deformation of the spring element is possible by applying force to the spring element. Because the spring element traverses a point of maximum deflection along the path of the wall element between its first and second position, which deflection is generated by an interaction with the wall element, the restoring force of the spring element is likewise a maximum at the point of maximum deflection. In fact, similar to the known actuation device, the spring element biases counter to the movement direction at the beginning of the movement path of the wall element, so that, in addition to the weight of the top receptacle, the spring force must be overcome until the point of maximum deflection is reached. However, the restoring force of the spring element then functions in an assisting manner, so that it assists the further movement of the wall element due to its restoring force and ultimately holds the wall element in the end position. The locking force of the spring force is based upon the fact that the force of the spring force must be again overcome during a movement from the end position.

[0009] An essentially unbiased state in the first and second position of the wall element, i.e. in the end positions of the wall element, means that the spring element has the least deflection in these positions; it experiences the deflection along the path between the first and second position. Thus, this also includes a state, in which a biasing of the spring element is provided, wherein this biasing, however, represents the minimal value of the

deflection and/or the restoring force along the path between the first and second position. Such a biasing is desirable in order to prevent an unintended release of the wall element.

[0010] In the following, the invention will be described in an exemplary manner with the assistance of the appended Figures, in which:

[0011] Fig. 1 shows the rear area of a vehicle, wherein a variable top receptacle and an accompanying actuation device according to the invention are indicated;

[0012] Fig. 2 shows an embodiment of the inventive actuation device in the first position; and

[0013] Fig. 3 shows the actuation device of Fig. 2 in the second position.

[0014] Fig. 1 shows the rear area 10 of a motor vehicle. A top receptacle 20, which is indicated in Fig. 1 with dashed lines, is disposed in the interior of the rear space, more particularly in the trunk 12. The top receptacle 20 is borne on the rear lid 14. In addition, the top receptacle 20 is movable between a first position, which is illustrated in Fig. 1, in which position it is prepared to accommodate a flap- or folding roof, and a second position (not illustrated), in which position it lays flat adjacent to the rear lid 14 in a folded-together manner, such that the trunk 12 can offer as much storage space as possible for luggage pieces and the like. The construction of the top receptacle 20 from a plurality of wall elements, which are hingedly connected with each other, is known.

[0015] An actuation mechanism 30 for the top receptacle 20 is mounted on one of the wall elements and/or on a flap element connected with a wall element in order to move the top receptacle 20 between the first and the second position. The actuation mechanism 30 thus serves, in particular, to assist the movement of the top receptacle 20. The movement is released, e.g., manually by means of a lever or a grip or by a not-illustrated electronic actuation.

[0016] In the following, the actuation mechanism 30 for the top receptacle will be explained with reference to Figs. 2 and 3. Fig. 2 shows the actuation mechanism 30 in the first position (low position of the rear receptacle, which corresponds to the illustration in Fig. 1) and Fig. 3 shows the actuation mechanism 30 in the second position (high position of the top receptacle, folded-together top receptacle position). The actuation device 30 comprises a wall- or flap element 22 of the top receptacle 20, which element is either intrinsically formed by a wall element of the top receptacle or is mounted on such a wall element as a lever-like element. The wall element 22 of the top receptacle is pivotable

about the angle α between the first position and a second position, which angle is bounded by the connection lines in the first and in the second position, respectively, between the center of gravity of the wall element and its center of rotation.

[0017] A cam-shaped lever element 32 is provided on the wall element 22. The lever element 32 is rigidly connected with the wall element 22 at the pivot axis of the wall element and protrudes from the wall element 22 in a direction perpendicular to the pivoting plane of the wall element 23 [*sic,* 22] (the direction perpendicular to the plane of the drawing in Figs. 2 and 3). The lever element is provided with two substantially planar side surfaces 32a, 32b that lie perpendicular to the plane of the pivoting movement and define an angle γ, preferably $0° < \gamma < 90°$. The two side surfaces 32a, 32b are connected by a curved surface 32c (circular cylinder segment) that likewise lies perpendicular to the plane of rotation, so that a pointed, sharp-edged junction between the side surfaces 32a, 32b is not provided.

[0018] Furthermore, the lever element 32 is oriented such that it is in contact with a leaf spring 34, which is fixedly borne in a clamped manner, on one of the side surfaces 32a, 32b in the first end position as well as in the second end position (Fig. 3). For this purpose, the lever element 32 is offset relative to the flap element 22 by an angle β. This leads to a first side wall surface 32a of the lever element 32 being in contact with the leaf spring in the first position (Fig. 2) and a side wall surface 32b of the lever element 32 that opposes the first side wall surface 32a contacting the leaf spring 34 in the second position.

[0019] A bracket 36 is provided between the wall element 22 and the lever element 32 in the illustrated embodiment, which bracket 36 is substantially L-shaped in the top view of Figs. 2 and 3 and is fixedly borne, i.e. translationally and rotationally unmovable, on the vehicle chassis, e.g., on the rear lid 14. Thus, during a pivoting movement of the wall element 22 and the lever element 32, the bracket 36 does not pivot therewith. The leaf spring 34 is affixed to the bracket 36 at a first connection point 37. It is designed as a strip-shaped leaf spring 34, wherein its opposing end is accommodated in a guide 38 so as to be displaceable in the longitudinal direction, so that a portion of the leaf spring 34 remains in the guide and does not shift similar to the free end of a fixed beam when the leaf spring 34 is pressed by the lever element 32 during the pivoting movement of the wall element 22. Rather, only an elastic flexing of the leaf spring 34 is possible. The strip-shaped leaf spring 34 substantially conforms to the shape of the bracket 36, i.e. it is also L-shaped and/or curved. The leaf spring 34 is preferably curved such that its radius of curvature is opposite to the curvature of the junction region 32c of the bracket [*sic*, lever element] 32. The

bracket 36 and likewise the leaf spring 34 are, however, not limited to the illustrated shapes. To the contrary, all shapes are conceivable for the bracket 36 as well as for the spring element 34, as long as the desired interaction with the lever element 32 and/or the wall element 22 is possible. The shape and the form of the lever element 32, the bracket 36, the wall element 32 as well as the leaf spring 34 are thereby adapted to the neighboring vehicle components, such as e.g. a panel 16, so that they do not strike or hit the neighboring components when moving.

[0020] For changing the position of the variable top receptacle, i.e. the wall elements and the elements connected thereto, which top receptacle is not illustrated in Fig. 2 and 3, the movement of the top receptacle is initiated, e.g., manually or with electronic assistance. For this purpose, e.g., a grip is pivoted, which grip is mounted on a wall element of the top receptacle 20, and consequently a first movement path is traversed.

[0021] For example, the wall element 22 is pivoted from the position illustrated in Fig. 2 in the counter-clockwise direction. By the pivoting of the wall element 22, the lever element 32 is moved and pivoted therewith, wherein its side wall 32a hits against the spring element, which is formed as leaf spring 34, on one of the legs of the leaf spring 34 and remains in contact during the pivoting movement. During a continuing pivoting movement in the counter-clockwise direction, the leaf spring 34 is thus deformed, wherein its restoring force increases up to a point of maximum deflection. In this first pivoting range, which extends from the position illustrated in Fig. 2 until approximately a position aligned with the bisecting line of the pivot angle α, the restoring force, which acts on the lever element 32 and thus the wall element 32, continuously increases, wherein this restoring force urges the wall element 22 back towards the first position (Fig. 2). When the point of maximum deflection (dead point) is overcome by a continuing pivoting movement, at which point the connecting line between the center of rotation of the lever element and its contacting point on the leaf spring lies perpendicular to a tangent on the leaf spring, the second side surface 32b of the lever element 32 arrives in contact with the leaf spring. The circular arc-shaped side wall surface 32c serves to ensure a uniform movement within this junction range. This circular arc shape in the junction region prevents an excessive increase of the force to be overcome during the continuing pivotable movement of the wall element 22.

[0022] In the second half of the movement path, i.e. the part of the movement path of the wall element 22 that lies between the bisecting line of the angle α and the second end position of the wall element 22, the now diminishing restoring force of the leaf spring 34 acts to further assist the pivoting movement during continuing pivoting movement. Thus,

after overcoming the dead point (point of maximum deflection of the leaf spring 34), the wall element 22 is urged into the second position (Fig. 3) by the restoring force of the leaf spring without further application of force from the outside.

[0023] Since the substantially straight side wall surfaces 32a, 32b, respectively, are in contact with the leaf spring in the first as well as the second position, the actuation device 30 simultaneously serves as a securing device in order to retain the wall element 22 in the first and second positions, respectively. The straight wall surfaces 32a, 32b ensure that a certain amount of force must be applied in order to get proximal to the dead point of the leaf spring 34, so that an undesired release of the position of the wall element 22, e.g., by an impact applied to the vehicle, is prevented. This is achieved, e.g., by the straight side wall surface 32a of the lever element 32 initially being in contact with a straight section of the leaf spring 34 starting from the position illustrated in Fig. 2 and a straight side wall surface 32b of the leaf spring 34 again being in contact with a straight section of the leaf spring 34 during the end phase of the pivoting movement.

[0024] Preferably, the lever element 32 formed as such is directly mounted at the center of rotation of the wall element 22, because the lever forces can thereby be minimized.

[0025] The essential aspect of the invention thus lies in replacing a relatively costly construction of an actuation mechanism that is assisted by a pneumatic spring with a simpler device that simultaneously undertakes the function of a latch in the end positions.

Reference Numbers

[0026]	10	Rear Area of a Vehicle
[0027]	12	Trunk
[0028]	14	Rear Lid
[0029]	16	Panel
[0030]	20	Top Receptacle
[0031]	22	Wall Element
[0032]	30	Actuation Device
[0033]	32	Lever Element
[0034]	32a	First Side Wall Surface
[0035]	32b	Second Side Wall Surface
[0036]	34	Leaf Spring
[0037]	36	Bracket
[0038]	37	Connection Point
[0039]	38	Guide